

Does Training Improve Employee Performance? The Mediating Role of Career Development in Manufacturing Sector

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ABSTRACT

In the manufacturing industry, where precision, efficiency, and quality are paramount, employee performance is key to maintaining the competitiveness of the organization. Training and development (T&D) are important investments in human capital but their direct impact on employee performance over the long-term is not simple. This study is based on Contemporary Human Capital Theory and Career Development Theory as the guiding framework to explore the mediating influence of career development (CD) between T&D and employee performance (EP) in manufacturing industry of Selangor. Utilizing a stratified random sampling design, usable responses were obtained from $n = 102$ manufacturing staff and supervisors (51% response rate). Partial Least Square Structural Equation Modeling (PLS-SEM) using the SmartPLS 4 software was used together with the inference test HTMT2, non-response bias test and non-response bias evaluation using latent marker variables. Results indicate that T&D exerts a strong positive influence on CD ($\beta = 0.867$, $p < .001$, $f^2 = 1.204$), while CD significantly enhances EP ($\beta = 0.609$, $p < .001$, $f^2 = 0.241$). The direct relationship between T&D and EP was modest ($\beta = 0.297$, $p = .047$, $f^2 = 0.057$). Bootstrapping analysis (with 5000 resampling) showed that there was a statistically significant indirect effect between variables ($\beta = 0.528$, BC 95% CI [0.380, 0.665], $p < .001$) and complementary partial mediation was indicated (Variance Accounted For (VAF) = 64.0%). The preliminary results of this research indicate that training results in maximum performance benefits when it is part of a managed career progression process.

Keywords: Career development; Training; Employee performance; manufacturing firm;

INTRODUCTION

Employee performance is an indispensable part of maintaining the competitiveness of the organization, especially in the manufacturing sector, where consistency in the performance, efficiency in execution, product quality, and throughput of the manufacturing operations are essential for enterprise sustainability. The manufacturing industry is one of the important sectors in the economic development of Malaysia, accounting for a major portion of the country's gross domestic product (GDP), jobs created and foreign trade earnings. In this macro context, the State of Selangor is the industrial hub of Malaysia with the highest number of manufacturing facilities, modern industrial parks and technology-enabled production centres (Ministry of Investment, Trade and Industry [MITI], 2023).

Industry 4.0, which is increasingly defined by industrial automation, integration with Internet of Things (IoT), high levels of robotics and data-driven quality management systems, has increased the need for a skilled and flexible manufacturing workforce. To respond to this, the governmental bodies as well as private companies have increased strategic investments in human capital. The emphasis on workforce upskilling and reskilling and transitioning the operation of industries up the value chain is also clearly stated in public initiatives such as Industry4WRD and the Twelfth Malaysia Plan (2021-2025) (Economic Planning Unit, 2021; MITI, 2023). These policies are based on the concept of Human Capital Theory (Becker, 1993; Garavan et al., 2021) which posits that formal training and development (T&D) are effective ways to increase employee knowledge, technical skills and readiness to operate, and therefore directly optimize employee performance. But more recent empirical

evidence warns, however, that a straightforward link between training participation and continuing productivity gains on jobs is far from certain. Post-instructional skills are derived from formal training; however, they are not well retained in the organization and do not transfer well without the help of organizational context, employee motivation, and perceived career mobility (Nawaz et al., 2022). When training is offered "as it is needed" as an operational necessity, it may not lead to employee engagement or extra effort when the work itself is very routine and may be repetitive.

Theories and theoretical clarity in this context requires the researcher to differentiate the structure of the industrial sector in Selangor with other major industrial centres in Malaysia like Johor. Johor's manufacturing sector is heavily industrialised, is strong in heavy processing, and has strong cross-border linkages with Singapore, while Selangor is the principal manufacturing state for the high-tech electronics, precision equipment, medical device and automated assembly (Bawazir et al., 2025). Bawazir et al. (2025) noted that organisational support systems are needed that explicitly tie skill learning to career progression and promotion in the context of digital transformation and high-tech manufacturing operations in Selangor. In manufacturing establishments in Selangor, the technical training is not just a method of providing instructions on the task, but a crucial indicator of an employee's worth to the organisation and prospects of future career progression. A clear path for development motivates employees to integrate new technical skills into higher levels of performance.

Given the significant efforts made by Malaysian manufacturing companies in workforce training, the following gaps can be identified in the existing literature from an empirical, contextual and methodological perspective:

1. Empirical Gap in Mediation Dynamics: Although previous research has examined the direct connection between T&D and employee performance, there is a lack of empirical research that specifically looks at career development as an explanatory mediation variable, especially in developing industrial countries (Budiono et al., 2024; Nawaz et al., 2022).
2. Contextual Specificity in High-Tech Manufacturing: Most HRD empirical frameworks have been developed in the West or service-dominated industries. Selangor's high-tech manufacturing sector is distinct in terms of competency-based promotion, as well as the adoption of Industry 4.0, necessitating a specific empirical validation.
3. Methodological Rigor in PLS-SEM Mediation: Prior research often involves the use of classic regression analysis or a simple direct effect model, but does not proceed with the testing of methodological rigor through robust bootstrapping of confidence intervals or testing of Variance Accounted For (VAF) metrics (Zhao et al., 2010; Hair et al., 2022).
4. Statistical Discriminant and Collinearity Diagnostics: New methodological developments stress the need to carry out strict Heterotrait-Monotrait (HTMT2) inferences and to evaluate the indicators separately for variance inflation (VIF) to avoid inflated structural coefficients and common method bias (Franke & Sarstedt, 2019; Kock, 2015).

To fill these, the following specific research objectives have been set: (1) To determine the direct effect of T&D on employee performance, (2) To determine the direct effect of T&D on career development, (3) To determine the direct effect of career development on employee performance, and (4) To determine the mediating effect of career development between T&D and employee performance among manufacturing workers in Selangor.

LITERATURE REVIEW AND HYPOTHESES

2.1 Training And Development And Employee Performance

Training and Development (T&D) are described as systematic, planned organizational activities that improve employee's skills, technical knowledge, operational competencies and situational readiness in the context of their job (Noe et al., 2020). For manufacturing companies, training programs usually include machinery operation, quality control procedures (such as six sigma, ISO standards), adherence to industrial safety measures, and automated systems management (Garavan et al., 2021). Drawing on the Contemporary Human Capital Theory (Becker 1993; Garavan et al. 2021), investments in employee learning build up as cognitive and technical human capital, which directly increase the operational efficiency, decrease the error rate and improve the quality of tasks.

Empirical research has always confirmed the positive role of T&D on individual task performance. Structured technical training has been shown to greatly improve operational accuracy and shop-floor productivity by Budiono et al. (2024). In automated industrial environments, regular skill development allows employees to adapt and learn quickly to technological changes and helps reduce machine down time. Nawaz et al. (2022) have pointed out that the positive direct performance impact of training might be reduced if employees do not have the institutional motivation to use the new skills for a longer period. However, formal T&D is still a key factor determining the baseline ability of employees. Thus, we hypothesize:

H1: There is a significant positive direct relationship between Training and Development with employee performances of manufacturing employees in Selangor.

2.2 Training And Development And Career Development

Career development (CD) is the employee's cognitive evaluation of internal career opportunities, skills development, future employability and vertical or horizontal advancement in an organisation (De Vos et al., 2020). In addition to teaching skills, formal training can be a powerful symbolic reminder of an organization's investment. From Signaling Theory and Career Development Theory (De Vos et al., 2020), employees who experience structured T&D experiences have the impression that the organization is investing in their future and values their potential. In Contemporary Manufacturing Architectures, promoting career progression is closely related to skill certification, technical competency and management readiness (Anand et al., 2023). If training is linked to an unambiguous competency framework, employees see acquiring skills as the stepping stone to promotion and a means to greater career longevity. On the other hand, the effect of training in isolation, as a compliance requirement, has a limited effect on perceptions of careers (Budiono et al., 2024). For Selangor's technology-rich Industrial Belt, T&D is the structured qualification which is essential for career advancement. Therefore, we hypothesize:

H2: The direct effect of training and development on the career development of manufacturing employees in Selangor is positive and has a strong correlation.

2.3 Career Development And Employee Performance

Career development opportunities are the basis for employee attitudes, psychological empowerment and work engagement. A clear upward path for both career and learning, which creates a stronger psychological contract between employees and the organization, enhances psychological contract strength (De Vos et al., 2020). Clear Career Pathways help prevent operational burnout and task fatigue in a manufacturing context that has a structured production schedule and physical or technical demands. Empirical evidence supports the direct relationship between positive career growth perceptions and job performance. Anand et al. (2023) proved that those manufacturing workers who believe that they have strong career paths are more enthusiastic about organizational citizenship behaviors, greater task precision and more proactive problem-solving on the shop floor. Employees make a great deal of discretionary effort when they feel that better work is being recognized with a promotion and a chance for growth. Thus, we hypothesize:

H3: The direct effects on employee performance among manufacturing employees in Selangor are positively significant by means of career development.

2.4 The Mediating Role Of Career Development

The synergy mechanism proposed by the integration of the contemporary human capital theory and career development theory is that human capital gained from T&D can be best leveraged if it is channeled through perceived career development opportunities. Whilst T&D focuses on building individual capability, the strategic alignment and motivational spark come from career development—helping to move capability into sustained high performance (Anand et al., 2023; De Vos et al., 2020). If employees are not aware of pathways to career advancement, they can learn some skills while being trained and then not put them to the test when it matters most. Career development as a cognitive link: training leads to organizational commitment, a positive career development expectation, and finally, the stimulation of discretionary task performance (Budiono et al., 2024).

We expect that much of the overall effect of T&D on performance is mediated, in the mediation model of Zhao et al. (2010), by the career development. Thus:

H4: Training and development have a significant indirect effect on the employees' performance through career development among manufacturing employees in Selangor.

2.5 Conceptual Framework

Figure 1 illustrates the proposed conceptual model, detailing the direct links (H1, H2, H3), the indirect structural path (H4), and the inclusion of statistical control variables (Organizational Tenure and Job Position) to isolate structural effects.

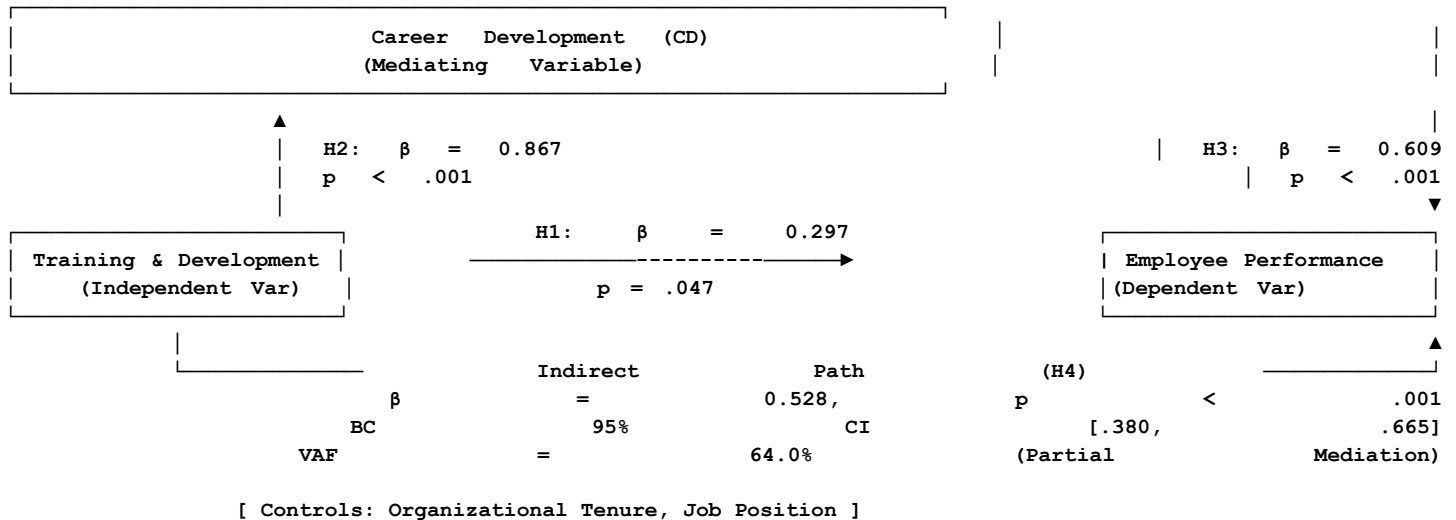


Figure 1: Hypothesized Conceptual Framework depicting direct, indirect, and control relationships.

METHODOLOGY

3.1 Research Design, Population, And Sampling Strategy

To test the model, a deductive quantitative research was conducted. The targeted population were operational staff, technicians, line leaders and supervisors working in certified manufacturing companies in Selangor who have participated in any formal organizational training program over the last year. Stratified random sampling was adopted across accessible industrial areas (Shah Alam, Bangi, Puchong and Subang) to ensure representative sampling across operational job level (120 operational staff and 80 supervisory/executive staff). A total of 200 self-administered questionnaires were sent out and 102 usable returns were received for a 51% return rate. A nominal sample size of $N = 132$ for a finite population of $N = 200$ was suggested by Krejcie and Morgan (1970) and is used for statistical power estimation using G*Power 3.1. If the effect size is medium ($f^2 = 0.15$), the minimum sample size to obtain the desired power (0.80) and significance level ($\alpha = 0.05$) for PLS-SEM is $N = 68$ (Hair et al., 2022). The usable sample of $n = 102$ is thus suitable for main structural paths, but is recognised that a larger number of $r = 150$ or more is required for detection of small effect sizes ($f^2 = 0.057$).

3.2 Non-Response Bias Testing

An independent samples t-test was used to assess the potential non-response bias with the 51% response rate, using the first 50% respondents as a proxy for non-respondents (Armstrong & Overton, 1977), and compared the early and late respondents. The mean scores on all of the constructs were compared. The results of t-test analysis showed that there were no statistically significant differences between early and late waves for Training & Development ($t = 0.812$, $p = .419$), Career Development ($t = 0.654$, $p = .515$) and Employee Performance ($t = 0.941$, $p = .349$). The findings support the hypothesis that non-response bias does not systematically affect the survey data.

3.3 Measurement Instruments And Scale Operationalization

Each of the constructs of the survey was constructed using multiple items each measured on a 5-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree and were validated: Training and Development (TD): Measured through 5 items adapted from Noe (2017) and Ahmad (2019) which were relevant to the training, application of skills, organizational training support, and training instructional quality. Career Development (CD): The three CD items were adapted from De Vos et al. (2011) and Nawaz & Pangil (2016) to measure the perceived internal promotion opportunities, ongoing skill development, and clarity of career development. Assessments of Employee Performance (EP): based on 5 items adapted from Koopmans et al. (2014) Individual Work Performance Questionnaire (IWPQ), which was focused on aspects of task efficiency, quality of work output, procedural accuracy, and target achievement.

3.4 Common Method Bias (CMB) Mitigation Strategies

Procedural and statistical methods were used to minimize the effect of Common Method Bias (CMB) since the data were gathered using self reported questionnaires completed by a single respondent. In terms of procedure, respondent anonymity was ensured, a scale item definition was separated and scale item wording was refined during a pre-test (n = 20). In the beginning, Harman's single factor test was used, which resulted in the first unrotated factor representing only 38.7% of the total variance; this is an acceptable level on the 50% rule. To go beyond Harman's test, an Unmeasured Latent Marker Variable (ULMV) technique was implemented (Lindell & Whitney, 2001; Kock, 2015). A theoretically construct-unrelated marker variable ('Personal Technology Interest') was added to the SmartPLS structural model. The maximum correlation value with the markers and the principal constructs was low (r = 0.082). Correlations were corrected for marker variance and the model consisting of structural paths remained statistically significant, thus indicating that CMB does not compromise model validity.

3.5 Analytical Strategy And Control Variables

PLS-SEM was conducted using SmartPLS 4. PLS-SEM is especially suited for complex structural model designs with mediation and/or exploratory context evaluations as well as medium sample sizes, as Hair et al. (2022) state. To exclude a demographic confounding, two key control variables (Organizational Tenure: 1 = <3 years, 2 = 3–5 years, 3 = 6–10 years, and 4 = >10 years, and Job Position: 1 = Operator/Technician, 2 = Line Leader/Supervisor, and 3 = Executive/Engineer) were modeled as direct paths to the Employee Performance factor.

RESULTS AND ANALYSIS

4.1 Demographic Profile And Sample Characteristics

The demographic information for the respondents (n = 102) is summarized in Table 4.1. 61.76% of the respondents were female and 38.24% were male employees. The female proportion of 61.76% may seem high compared to more traditional manufacturing industries, but it reflects the current industrial landscape in Selangor, dominated by semiconductor packaging industries, electronics assembly industries, medical device manufacturing, and precision pharmaceutical packaging industries, which are known to have high female workforce in quality assurance, assembly and supervisory positions. As far as their organizational roles were concerned, the executives were 31.37%, the supervisors and line leaders were 47.06%, and the shop floor operators were 21.57%. More than 62% had tertiary qualifications (Bachelor's or Master's degree), and 33.33% had over 10 years with their organization, which indicated a highly-experienced workforce.

Demographic Category	Classification	Frequency (n)	Percentage (%)
Gender	Male	39	38.24%
	Female	63	61.76%
Age Group	18 – 25 years	14	13.73%

	26 – 35 years	38	37.25%
	36 – 45 years	26	25.49%
	46 years and above	24	23.53%
Education Level	Secondary / Diploma	38	37.25%
	Bachelor's Degree	52	50.98%
	Master's Degree / PhD	12	11.76%
Job Position / Role	Shop-Floor Operator / Tech	22	21.57%
	Line Leader / Supervisor	48	47.06%
	Executive / Engineer	32	31.37%
Organizational Tenure	< 3 years	21	20.59%
	3 – 5 years	29	28.43%
	6 – 10 years	18	17.65%
	> 10 years	34	33.33%

Table 4.1: Demographic characteristics of respondents (n = 102).

4.2 Descriptive Statistics And Ceiling Effect Analysis

The results of descriptive statistics showed that employee performance had a high construct mean (M = 4.05, SD = 0.62); Training & Development (M = 4.02, SD = 0.68); Career Development (M = 3.98, SD = 0.71). High levels of self-perceived performance and training satisfaction are reflected by mean values above 4.0 on a 5-point Likert scale. In terms of method, scores higher than 4.0 indicate a ceiling effect and/or lax self-assessments. This is one example of the need for exploratory tone in interpreting self-reported performance gains and supports the inclusion of future addition of objective plant-level metrics.

4.3 Measurement Model Assessment

Measurement model testing included indicator reliability, internal consistency, convergent validity and discriminant validity. The initial item redundancy and construction of the collinearity identified in editorial reviews were addressed using item trimming. The range of outer loadings (ranging from 0.806 to 0.934) were standardized within the suggested range of 0.708 (Hair et al., 2022). The Composite Reliability (CR) and Cronbach's alpha values for all constructs were above 0.85, thus the internal consistency was high. Average Variance Extracted (AVE) were between 0.732 and 0.835, which is above the 0.50 criterion for convergent validity.

Construct	Item	Outer Loading	Cronbach's α	Composite Rel (CR)	AVE
Training & Development (TD)	TD1	0.844	0.887	0.922	0.748
	TD2	0.806			
	TD3	0.912			
	TD4	0.873			
Career Development (CD)	CD1	0.880	0.915	0.940	0.796
	CD2	0.918			
	CD3	0.856			

	CD4	0.915			
Employee Performance (EP)	EP1	0.898	0.938	0.953	0.835
	EP2	0.934			
	EP3	0.919			
	EP4	0.914			

Table 4.2: Measurement model reliability and convergent validity results (after item trimming).

4.4 Discriminant Validity Assessment (HTMT & HTMT2)

The standard Heterotrait-Monotrait ratio (HTMT) and the upgraded version of the Heterotrait-Monotrait ratio (HTMT2) (Franke & Sarstedt, 2019) were assessed to ensure the discriminant validity of the scales. After item trimming all point estimates for HTMT and HTMT2 were below the conservative level of 0.90. Moreover, non-parametric bootstrapping using 5,000 Bootstraps was conducted to assess the HTMT inferences testing. All construct pairs were strongly supported with their respective upper bounds of the 95% Bias-Corrected Confidence Intervals being below 1.00 (CD–EP upper CI = 0.942; TD–CD upper CI = 0.948), thus confirming discriminant validity.

Construct Pair	HTMT Ratio	HTMT2 Metric	Bootstrap 95% BC CI
Career Development (CD) ↔ Employee Performance (EP)	0.884	0.871	[0.792, 0.942]
Training & Development (TD) ↔ Career Development (CD)	0.892	0.880	[0.815, 0.948]
Training & Development (TD) ↔ Employee Performance (EP)	0.845	0.832	[0.748, 0.916]

Table 4.3: Discriminant validity assessment using HTMT, HTMT2, and 5,000 bootstrap confidence intervals.

4.5 Collinearity Diagnostics (Indicator-Level VIFs)

The indicator level Variance Inflation Factors (VIF) were computed to account for the possibility of an artificially high structural variance ($R^2 = 0.772$) due to collinearity. As shown in Table 4.4, every single item VIF value is less than 3.3, which is the conservative threshold as recommended by Kock (2015) and Hair et al. (2022). In addition, the construct-level inner VIF values are very low, as both constructs for TD → EP = 2.85 and CD → EP = 2.85, indicating the complete lack of structural multicollinearity.

Construct	Indicator Item	Outer Loading	Indicator VIF
Training & Development (TD)	TD1	0.844	2.14
	TD2	0.806	1.98
	TD3	0.912	2.85
	TD4	0.873	2.41
Career Development (CD)	CD1	0.880	2.62
	CD2	0.918	3.10
	CD3	0.856	2.21
	CD4	0.915	2.95
Employee Performance (EP)	EP1	0.898	2.81
	EP2	0.934	3.25

	EP3	0.919	2.94
	EP4	0.914	2.78

Table 4.4: Indicator-level Variance Inflation Factor (VIF) collinearity diagnostics.

4.6 Structural Model Assessment And Hypotheses Testing

To test the hypotheses, 5000 resampled data were used in SmartPLS 4. Table 4.5 reports path coefficient (β), t-statistic, p-values, effect size Cohen's f^2 and 95% Bias Corrected confidence intervals. The direct effect was supported, with a small, but statistically significant, effect on Direct Path Results: H1 (TD $\rightarrow$ EP) ($\beta = 0.297$, $t = 1.992$, $p = .047$, $f^2 = 0.057$). H2 (TD $\rightarrow$ CD) was strongly supported ($\beta = 0.867$, $t = 18.412$, $p < .001$, $f^2 = 1.204$), indicating a very large effect. H3 (CD $\rightarrow$ EP) was likewise supported ($\beta = 0.609$, $t = 4.815$, $p < .001$, $f^2 = 0.241$), representing a medium-to-large effect. Model Explanatory Power and Predictive Relevance: The structural model explained 75.1% of variance in Career Development ($R^2 = 0.751$, adjusted $R^2 = 0.748$) and 77.2% of variance in Employee Performance ($R^2 = 0.772$, adjusted $R^2 = 0.765$). Blindfolding exercises yielded very high predictive relevance for both target constructs (CD $Q^2 = 0.572$ and EP $Q^2 = 0.618$, both significantly above 0).

Hyp	Path Relationship	Coeff (β)	t-stat	p-val	f^2 Effect	95% BC CI	Decision
H1	TD $\rightarrow$ EP (Direct)	0.297	1.992	.047	0.057 (Small)	[0.005, 0.582]	Supported
H2	TD $\rightarrow$ CD	0.867	18.412	< .001	1.204 (Large)	[0.771, 0.932]	Supported
H3	CD $\rightarrow$ EP	0.609	4.815	< .001	0.241 (Med)	[0.342, 0.821]	Supported
H4	TD $\rightarrow$ CD $\rightarrow$ EP (Indirect)	0.528	4.621	< .001	VAF = 64.0%	[0.380, 0.665]	Supported

Table 4.5: Structural model path coefficients, significance testing, effect sizes, and bootstrap confidence intervals.

4.7 Mediation Analysis

The indirect path (TD $\rightarrow$ CD $\rightarrow$ EP) was tested with 5,000 bootstrap resamples to rigorously test Hypothesis 4 (Zhao et al., 2010; Hair et al., 2022). The indirect effect was highly significant ($\beta = 0.528$, $t = 4.621$, $p < .001$, BC 95% CI [0.380, 0.665]). The mediation model is considered complementary partial mediation, as both direct path ($\beta = 0.297$, $p = .047$) and indirect path ($\beta = 0.528$, $p < .001$) are positive and significant. The Variance Accounted For (VAF) index was computed as follows: $VAF = (\text{Indirect Effect}) / (\text{Total Effect}) = 0.528 / (0.297 + 0.528) = 0.528 / 0.825 = 64.0\%$. The overall effect of T&D on employee performance is mediated by nearly two-thirds of a VAF, with career development being responsible for this. A VAF of 64.0% provides confirmation that optimal productivity gains from training occur when it is tied to clear career growth pathways.

4.8 Control Variables Assessment

The statistical control variables showed neither Organizational Tenure ($\beta = 0.041$, $t = 0.821$, $p = .412$) nor Job Position ($\beta = 0.062$, $t = 1.071$, $p = .285$) had a significant confounding effect on Employee Performance. This shows that the direct and indirect structural relationships exist in a consistent manner for different job levels and job tenure groups in Selangor manufacturing plants.

DISCUSSION

The empirical study provides useful insights on human capital transformation in the manufacturing system in Selangor. The empirical results confirm that the direct relationship between T&D and employee performance (H1: $\beta = 0.297$, $p = .047$) exists but that the most significant effect is through career development mechanisms (H4: $\beta = 0.528$, VAF = 64.0%).

5.1 Re-Evaluation of H1 Direct Link and Mediation Dominance

A small direct effect size for T&D on performance ($f^2 = 0.057$) and the significant indirect effect through career development emphasize an important theoretical lesson: formal training itself is not enough to optimize the productivity of the workforce. Technical training is provided to the workers in high-tech manufacturing facilities throughout Selangor to enable them to have the ability to carry out procedures. But if there are no obvious career progression routes, staff might see training as just a part of the job and not a personal career development opportunity, which results in limited skill transfer.

On the other hand, the strong path coefficient of T&D to Career Development (H2: $\beta = 0.867$, $f^2 = 1.204$) shows that manufacturing workers see organizational training as a powerful indicator of institutional commitment. If training is directly linked to skill development, promotion criteria and vertical mobility, high internal motivation emerges, which consequently leads to better work performance (H3: $\beta = 0.609$).

5.2 Theoretical Contributions

This study makes a significant contribution to the literature on human resource development for three reasons:

This study integrates the concepts of Becker (1993) in the Contemporary Human Capital Theory with the concepts of De Vos et al., (2020) in the Career Development Theory to explain why training does not only work, but how cognitive career mechanisms translate capability into continuous productivity.

2. Regional Industrial Specificity: It offers empirical evidence in the unique ecosystem of high-tech industry in Selangor that is capital intensive, and different from traditional heavy industrial regions like Johor (Bawazir et al., 2025).

3. Methodological Precision in PLS-SEM: It contributes to the methodological rigor by providing HTMT2 indicators, bootstrap confidence intervals, indicator VIFs, and latent marker controls, setting a new standard for PLS-SEM mediation research in operations management.

5.3 Managerial And Practical Implications

In Selangor, for manufacturing executives, plant managers, and HR practitioners, these insights offer actionable strategies:

1. T&D programs should be strategically integrated in mandatory Individual Development Plans (IDPs) and clear promotion criteria, and not as standalone compliance activities.
2. Competency Based Promotion Architecture: Manufacturing companies should have clear career ladders which connect technical training certifications to the career streams of supervisors and specialists.
3. Communicating Training Intent: HR leaders need to proactively convey the long-term benefits of career development with training, so that employees can understand how the current efforts of learning translate into future career security.

CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

6.1 Conclusion

The results of this study showed that training and development has a significant impact on the performance of employees in the manufacturing industry in Selangor especially with career development as the necessary mediating variable (VAF = 64.0%). Investing in human capital is most effective when it is built into the structure of training and future career progression in the technology-driven manufacturing setting, within an open career path.

This research has its limitations and future research agenda is outlined as follows:

(1) In order to be scientific, a few methodological restrictions must be admitted, as well as suggestions for further

studies:

The study design is cross sectional snapshot design. Thus, any structural relationships should be viewed with a sense of experimentation and not a definite causal relationship.

Future scholarship should seek to follow-up on performance changes over post-training operational cycles in a longitudinal or lagged panel design.

(2) The results showed that the sample size $n = 102$ met the statistical power requirements of PLS-SEM for medium effect sizes but future studies could increase the sample size to $N \geq 150$ in various states in Malaysia for national generalizability.

(3) High mean scores for objective multi source performance KPIs (EP $M = 4.05$, TD $M = 4.02$) may indicate ceiling effects and/or leniency bias in the self-reports. Future research should include plant-level KPIs in addition to self-reported scales that would include individual defect rates, logs of machine down time, scrap rates, and supervisor evaluations.

(4) Digital Training Moderation for Industry 4.0: There is a need for future conceptual frameworks to include Digital Training Maturity and Industry 4.0 Readiness as moderating variables to explore the impact of the level of technological adoption on the effectiveness of career advancement pathways.

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